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EXAMINER	
REDDING, THOMAS M	

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2624	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/535,466	FRADKIN ET AL.	
	Examiner	Art Unit	
	THOMAS M. REDDING	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 April 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 April 2008* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's response received on 4/4/2008 is fully considered herein. Claims 1-15 are currently pending. This action is non-final as some of the original grounds for rejection are improper. Applicant's arguments with respect to the 102(b) rejection are persuasive and that rejection is withdrawn. However, upon further consideration, a new grounds of rejection is made in view of Delingette (1999).

Drawings

2. In response to applicant's amendment of the drawings, the objections to figures 3 and 4 are withdrawn.

Claim Objections

3. In response to applicant's amendments to fix typographical errors in claims 5 and 6, the objections to claims 5 and 6 are withdrawn.

In response to applicant's amendment to correct the improper multiple dependencies in claims 7-14, the objections due to improper form are withdrawn.

Response to Arguments

Summary of Applicant's Remarks: The 102(e) rejection of claims 1, 2 and 15, based on Huang (US 2002/0133070) are improper because Huang does not disclose applicant's disclosed imaging system which: applies an adaptive 3D mesh model onto

the surface of an object in a medical image, generation of a simplex mesh model, or segmentation via a mesh model, estimation of the mapping fitness or refining the fitness of the mapping. Applicant cites the text of 35 U.S.C. 102(e) and emphasizes the standard for rejection under anticipation is identity.

Examiner's Response: The standard for rejection under 35 U.S.C. 102(e) is identity in reference to the claims, not in the disclosure. The elements of claims 1, 2 and 15 do not recite adaptive 3D mesh models, generation of simplex models or estimation and refinement of the fitness of the mapping .The claim does describe adjusting model resolution when reliable image features are found and Huang does suppress resolution of elements that are not of interest. Huang does teach the claimed elements of claims 1, 2 and 15 as described in the original rejection therefore the original rejection is proper and is maintained. If claims 1 and 15 were amended to actually include the limitation of a 3-D mesh model, it would overcome Huang.

Summary of Applicant's Remarks: The 35 U.S.C. 102(b) rejections of claims 1, 2, 6 and 15 based on Delingette are improper because Delingette's disclosed invention is not identical to the applicant's invention similar to the argument above. Specifically Delingette's Alphastation 200/233 was not used to implement a complete system for processing medical image data, does not teach dynamic adaptation of model resolution based on image feature reliability, estimating confidence factors on cells on the mesh model or adjusting model resolution based on these confidence factors.

Examiner's Response: The standard for rejection under 35 U.S.C. 102(b) is identity in reference to the claims, not in the disclosure. Delingette does describe evaluating computation times on a DEC Alphastation 200/233. Applicant raises the possibility that the Alphastation was merely used to estimate algorithm performance.

Delingette does not explicitly claim his system, but certainly indicates that he has a system. For that reason, the 102(b) rejection based on Delingette is withdrawn and a new 103(b) rejection is made in its place. The existence of a system is obvious.

Delingette's figure 28 on page 138 shows results that appear to be times of actual operations rather than estimates. On page 114, Delingette indicates that the paper describes “a shape recovery system” and "In Section 4, we describe the various components of our reconstruction system”. On page 141, in the conclusion Delingette refers to "the current implementation". It is clear that Delingette has implemented a system to perform the reconstructions described in his paper. Further, although not required by the claim language, several of the reconstructions illustrated are medical in nature (figure 21 - Skull, figure 23 - Vertebra, figure 29 – Lung, figure 30 – Heart) and in his conclusion on page 141, Delingette suggests working with medical images.

With respect to dynamic adaptation of model resolution based on feature reliability: On page 127 Delingette describes refinement and adaptation adding vertices and moving them toward points of high curvature. Figure 9(b) on page 121 shows

increased resolution at areas of higher curvature and the caption reads “Deformable simplex after adaptation of its reference metric parameter in order to increase the resolution in places with high curvature”. Points of high curvature inherently have increased information content in the form of more high frequency content and are consequently more reliable indications of shape than points of low curvature. More vertices are required in these areas to get an accurate shape model (“A good strategy is to concentrate vertices towards parts of high curvature into order to optimize the shape description”, Delingette, page 133, column 1).

Summary of Applicant’s Remarks: The rejections of claims 3, 4 and 6 under 35 U.S.C. 103(a) is improper because they rely upon the rejection of claim 1 under Delingette which was previously argued to be improper.

Examiner’s Response: The argument is moot in view of the updated rejection for claim 1.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 14 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In particular, claim 14, claims a computer program product without indication of what the product is. What structure is intended?

Additionally, referenced claim 11 is a system claim, not a method claim, it defines structure rather than steps. No steps for the computer program product are defined.

Further, claim 14 is rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a plurality of structural elements performing the claimed functions, does not reasonably provide enablement for a single structural element performing all of the claimed functions. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims ("A single means claim, i.e., where a means recitation does not appear in combination with another recited element of means, is subject to an undue breadth rejection under 35 U.S.C. 112, first

paragraph" because a single means claim covers "every conceivable means for achieving the stated purpose" and "the specification disclosed at most only those means known to the inventor" - *MPEP, at paragraph 2164.08(a)*).

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

The USPTO "Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility" (Official Gazette notice of 22 November 2005), Annex IV, reads as follows:

> Descriptive material can be characterized as either "functional descriptive material" or "nonfunctional descriptive material." In this context, "functional descriptive material" consists of data structures and computer programs which impart functionality when employed as a computer component. (The definition of "data structure" is "a physical or logical relationship among data elements, designed to support specific data manipulation functions." The New IEEE Standard Dictionary of Electrical and Electronics Terms 308 (5th ed. 1993).) "Nonfunctional descriptive material" includes but is not limited to music, literary works and a compilation or mere arrangement of data.
>
> When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized. Compare In re Lowry, 32 F.3d 1579, 1583-84, 32 USPQ2d 1031, 1035 (Fed. Cir. 1994) (claim to data structure stored on a computer readable medium that increases computer efficiency held statutory) and Warmerdam, 33 F.3d at 1360-61, 31 USPQ2d at 1759 (claim to computer having a specific data structure stored in memory held statutory product-by-process claim) with Warmerdam, 33 F.3d at 1361, 31 USPQ2d at 1760 (claim to a data structure per se held nonstatutory).
>
> In contrast, a claimed computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory. See Lowry, 32 F.3d at 1583-84, 32 USPQ2d at 1035.

Claim 14 is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows. Claim 14 defines a computer program product embodying functional descriptive material (i.e., a computer program or computer executable code). However, the claim does not define a “computer-readable medium or computer-readable memory” and is thus non-statutory for that reason (i.e., “When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized” – Guidelines Annex IV). The scope of the presently claimed invention encompasses products that are not necessarily computer readable, and thus NOT able to impart any functionality of the recited program. The examiner suggests amending the claim(s) to embody the program on “computer-readable medium” or equivalent; assuming the specification does NOT define the computer readable medium as a “signal”, “carrier wave”, or “transmission medium” which are deemed non-statutory (refer to “note” below). Any amendment to the claim should be commensurate with its corresponding disclosure.

Note:

“A transitory, propagating signal … is not a “process, machine, manufacture, or composition of matter.” Those four categories define the explicit scope and reach of subject matter patentable under 35 U.S.C. § 101; thus, such a signal cannot be patentable subject matter.” (In re Nuijten, 84 USPQ2d 1495 (Fed. Cir. 2007). Should the full scope

of the claim as properly read in light of the disclosure encompass non-statutory subject matter such as a “signal”, the claim as a whole would be non-statutory. Should the applicant’s specification define or exemplify the computer readable medium or memory (or whatever language applicant chooses to recite a computer readable medium equivalent) as statutory tangible products such as a hard drive, ROM, RAM, etc, **as well as** a non-statutory entity such as a “signal”, “carrier wave”, or “transmission medium”, the examiner suggests amending the claim to *include* the disclosed tangible computer readable storage media, while at the same time *excluding* the intangible transitory media such as signals, carrier waves, etc.

Merely reciting functional descriptive material as residing on a tangible medium is not sufficient. If the scope of the claimed medium covers media other than “computer readable” media (e.g., “a tangible media”, a “machine-readable media”, etc.), the claim remains non-statutory. The full scope of the claimed media (regardless of what words applicant chooses) should not fall outside that of a computer readable medium.

Claim Rejections - 35 USC § 102 (repeated from previous office action)

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent

granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1, 2 and 15 are rejected under 35 U.S.C. 102(e) as being anticipated by Huang et al. (US 2002/0133070 A1).

Regarding claim 1, Huang discloses [a]n image processing system having image data processing means of automatic adaptation of 3-D surface Model to image features, for Model-based image segmentation ("The field of the invention is magnetic resonance angiography", paragraph 1), comprising means of dynamic adaptation of the Model resolution to image features including means of locally setting higher resolution when reliable image features are found and means of setting lower resolution in the opposite case ("the invention includes acquiring and reconstructing a 3D image, acquiring and reconstructing a 3D mask image, producing a 2D projection image at a selected projection angle through the 3D image, producing a 2D projection mask image at the selected projection angle through the 3D mask image, and subtracting the 2D projection mask image from the 2D projection image", Huang, paragraph 14, reliable blood vessel image features are displayed at full resolution, other features are suppressed, effectively having no resolution).; and comprising viewing means for visualizing the images ("image data may be archived on the tape drive 112, or it may be further processed by the image processor 106 in accordance with the teachings of the present invention and conveyed to the operator console 100 and presented on the display 104", Huang, paragraph 24).

Regarding claim 2, Huang teaches having data processing means to define a feature confidence parameter for each image feature (“acquiring and reconstructing a 3D mask image”, Huang, paragraph 14, the mask image defines whether a region of the image is determined to be blood vessel structure or not), and to locally adapt model resolution according to it (“subtracting the 2D projection mask image from the 2D projection image”, Huang, paragraph 14, image features that are not of interest are given zero weight).

Regarding claim 15, Huang teaches [a]n image processing method, comprising steps of acquiring image data of a 3-D image with image features (“The present invention is a method and apparatus for producing a 2D projection image from a 3D image data set”, Huang paragraph 14), and automatically adapting 3-D surface Model to image features, for Model-based image segmentation (“angiogram-like picture of the vascular system”, Huang, paragraph 9), whereby: dynamically adapting the Model resolution to image features including locally setting higher resolution when reliable image features are found and setting lower resolution in the opposite case (“subtracting the 2D projection mask image from the 2D projection image”, Huang, paragraph 14); and comprising steps of visualizing the images (“image data may be archived on the tape drive 112, or it may be further processed by the image processor 106 in accordance with the teachings of the present invention and conveyed to the operator console 100 and presented on the display 104”, Huang, paragraph 24).

Claim Rejections - 35 USC § 103 (updated from prior action)

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 2 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Delingette (General Object Reconstruction Based on Simplex Meshes, 1999).

Regarding claim 1, Delingette teaches [a]n image processing method having image data processing means of automatic adaptation of 3-D surface Model to image features ("The first stage corresponds to the mesh deformation from an initial position to a close approximation of the dataset shape", Delingette, page 127, column 1, paragraph 4), for Model-based image segmentation ("The different tasks performed during the reconstruction include the segmentation of given objects in the scene", Delingette, page 111, abstract),

comprising means of dynamic adaptation of the Model resolution to image features (Delingette, page 121, figure 9b) including means of locally setting higher resolution when reliable image features are found and means of setting lower resolution in the opposite case ("Simplex meshes as triangulations are unstructured meshes and therefore can be locally refined or decimated", Delingette, Page 118, column 2,

paragraph 2, and table 5 showing high refinement corresponding to reduced distance error); and comprising viewing means for visualizing the images (“a disadvantage of using simplex meshes over triangulations is that they must be triangulated in order to be displayed”, Delingette, page 135, column 1, paragraph 3).

Delingette does not expressly disclose an image processing system.

However, Delingette provides ample evidence that he has implemented his system (“DEC Alphastation 200/233”, page 137, column 2, paragraph 4. He also makes mention of his "system" multiple times: “In this paper we present a shape recovery system”, page 114, column 2, paragraph 3, and "In Section 4, we describe the various components of our reconstruction system”, page 114, column 2, paragraph 5. He also makes reference to his implementation: “In the current implementation, we rely on an initialization algorithm that is limited to only three different topologies”, Delingette, page 141, paragraph 4. Delingette has clearly implemented his system)

It would have been obvious at the time the invention was made for one of ordinary skill in the art to provide the structure implied by Delingette to implement the methods disclosed by Delingette to actually implement the methods to generate a hight quality reconstruction of an object using simplex meshes.

Regarding claim 2, Delingette discloses data processing means to define a feature confidence parameter for each image feature (“the refinement measure is linked to the maximum distance to the data”, Delingette, page 137, column 2, paragraph 1), and to locally adapt model resolution according to it (“Meshes before and after refinement are shown in Fig. 27”, Delingette, page 173, column 2, paragraph 2).

Regarding claim 15, Delingette discloses [a]n image processing method, comprising steps off acquiring image data of a 3-D image with image features, and automatically adapting 3-D surface Model to image features, for Model-based image segmentation (“The first stage corresponds to the mesh deformation from an initial position to a close approximation of the dataset shape”, Delingette, page 127, column 1, paragraph 4), whereby:

dynamically adapting the Model resolution to image features including locally setting higher resolution when reliable image features are found and setting lower resolution in the opposite case (“the refinement measure is linked to the maximum distance to the data”, Delingette, page 137, column 2, paragraph 1) and comprising steps of visualizing the images (“a disadvantage of using simplex meshes over triangulations is that they must be triangulated in order to be displayed”, Delingette, page 135, column 1, paragraph 3 and figures 27 and 29 are examples of Delingette’s output images).

5. Claims 3-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Delingette (1999) in combination with Bernardini et al. (US 6, 968,299 B1).

Regarding claim 3, Delingette teaches a data processing means to define a feature confidence parameter as a parameter that depends on the feature distance ("the refinement measure is linked to the maximum distance to the data", Delingette, page 137, column 2, paragraph 1) and having data processing means to penalize the large distances ("Meshes before and after refinement are shown in Fig. 27", Delingette, page 173, column 2, paragraph 2).

Delingette does not explicitly describe the estimation of quality of this feature including estimation of noise, and having data processing means to penalize the noisy, although close features.

Bernardini working in the same field of endeavor of 3d modeling through mesh generation ("a method and apparatus are disclosed for finding a triangle mesh that interpolates a set of points obtained from a scanning system", Bernardini, column 3, line 47) does teach the estimation of quality of this feature including estimation of noise, and having data processing means to penalize the noisy, although close features ("points lying below the surface will not be touched by the ball and will not be part of the

reconstructed mesh, as shown in FIG. 2F", Bernardini, column 8, line 41, and "the ball-pivoting algorithm is robust in the presence of imperfect data", Bernardini, column 8, line 24, Bernardini's method omits noisy points resulting in coarser resolution in those regions).

It would have been obvious at the time the invention was made for one of ordinary skill in the art to use the ball-pivoting algorithm of Bernardini with the simplex mesh system of Delingette to provide a triangulation method that is "robust in the presence of imperfect data" (Bernardini, column 8, line 24)

Regarding claim 4, the combination of Delingette and Bernardini teaches data processing means for decreasing the resolution of the Model in absence of confidence and gradually increasing the resolution of the Model with the rise of feature confidence (Delingette, figure 27 shows resolution varying as a result of a refinement operation).

Regarding claim 5, the combination of Delingette and Bernardini discloses data processing means for causing low local resolution to constrain local surface curvature, for preventing the model surface from self-intersections ("Our deformable model framework is based on a Newtonian law of motion (see Eq. (10)) that includes a damping factor in order to prevent oscillations of the system." Delingette, page 135, column 2, paragraph 1 and "For $\gamma = 0.20$, we observe that the resulting mesh self-intersects", Delingette, page 136, paragraph 1, and "If γ is too small, the mesh may not

converge towards the right shape, especially when the mesh is far away from the data.", Delingette, page 136, paragraph 2, Delingette reveals that when the mesh is farther away, as will occur at lower resolution, the mesh may not converge properly. He provides a damping mechanism to increase the stability of the deformation in order to avoid self-intersection).

Regarding claim 6, the combination of Delingette and Bernardini discloses means to make feature confidence available for model adaptation, comprising means to display the Model regions with different colors representing the confidence at the location of said regions for the user to supervise the deformation process of the Model and to locally assess its final quality (Delingette, Figure 21 (b) – color coding of the distance of mesh vertices to the dataset).

Regarding claim 7, the combination of Delingette and Bernardini teaches means for:

generating a Mesh Model, formed of polygonal cells and deforming the Mesh Model in order to map said Mesh Model onto said object of interest ("The first stage corresponds to the mesh deformation from an initial position to a close approximation of the dataset shape", Delingette, page 127, column 1, paragraph 4, and figure 25)

The combination of Delingette and Bernardini given above does not explicitly teach a means for [a]cquiring a three-dimensional image of an object of interest to be segmented.

Bernardini further teaches a means for [a]cquiring a three-dimensional image of an object of interest to be segmented ("The acquisition system 120 may be embodied, for example, as Rapid 3D Color Digitizer Model 3030, commercially available from CyberWare of Monterey, Calif", Bernardini, column 5, line 17).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use a 3D digitizer as taught by Bernardini in the combination of Delingette and Bernardini because "the acquisition system 120 produces sets of range images, i.e. arrays of depths, each of which covers a subset of the full surface", Bernardini, column 5, line 20, a source of data is needed for the system to have any utility).

6. Claims 8 - 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Delingette (1999) and Bernardini et al. (US 6, 968,299 B1) in combination with Vannah (US 6,201,889).

Regarding claim 8, the combination of Delingette and Bernardini teaches the elements of claim 7 as given above.

While the combination of Delingette and Bernardini does teach color coding the mesh as indicated above, the combination of Delingette and Bernardini does not teach

means for: Constructing a Color Coding Table wherein predetermined colors are associated to given confidence parameter values; Associating the confidence parameter values of a given cell of the Mesh Model to a color given by the color coding Table corresponding to said confidence parameter values.

Vannah, working in the same problem solving area of providing user feedback of 3D data quality, does teach means for (“a processor connected to the probe and the output device and arranged to analyze the digital data and provide a feedback code indicating the quality of the digital data points”, Vannah, column 3, line 63): Constructing a Color Coding Table wherein predetermined colors are associated to given confidence parameter values (“In a sixth step, 60, the system draws the compartment on a 3-D map, e.g., on a CRT, with the feedback code, e.g., a visual code, corresponding to the calculated quality”, Vannah, column 9, line 27); Associating the confidence parameter values of a given cell of the Mesh Model to a color given by the color coding Table corresponding to said confidence parameter values (“This is accomplished by obtaining the proper feedback code signal for each compartment from a look-up table in memory that associates particular code signals with specific quality values”, Vannah, column 9, line 29).

It would have been obvious at the time the invention was made for one of ordinary skill in the art to combine the color coded feedback means and method taught by Vannah in the adaptive mesh system of the combination of Delingette and Bernardini to “provide the user real-time feedback as to the quality of the data at any area of the

map. The feedback code indicates whether the data obtained at a particular location is acceptable, thus signaling the user to re-sample locations in which sampling was too sparse, erroneous, or contained excessive noise (random error)", Vannah, column 2, line 66).

Regarding claim 9, the combination of Delingette, Bernardini and Vannah teaches a data processing means for ("a processor connected to the probe and the output device and arranged to analyze the digital data and provide a feedback code indicating the quality of the digital data points", Vannah, column 3, line 63): Performing a color coding operation by attributing to said given cell, the color determined from the Color Coding Table, corresponding to the confidence parameter values ("This is accomplished by obtaining the proper feedback code signal for each compartment from a look-up table in memory that associates particular code signals with specific quality values", Vannah, column 9, line 29); and display means for ("the output device can be, e.g., a cathode ray tube or other screen, or a printer", Vannah, column 4, line 10): Displaying the image of the Mesh Model having cells colored according to the color-coding operation ("transmit the feedback code to the output device", Vannah, column 4, line 8).

Regarding claim 10, the combination of Delingette, Bernardini and Vannah teaches wherein the color-coding operation is performed for all the cells or for a predetermined number of cells ("This is accomplished by obtaining the proper feedback code signal for each compartment from a look-up table in memory that associates

particular code signals with specific quality values", Vannah, column 9, line 29, Vannah can code all the cells).

Regarding claim 11, the combination of Delingette, Bernardini and Vannah as given above does not teach means for: Taking a decision to stop the process of mapping the Mesh Model onto the object of reference in function of a predetermined confidence level.

Vannah does further teach means for: Taking a decision to stop the process of mapping the Mesh Model onto the object of reference in function of a predetermined confidence level ("If the key pressed was "F" (or some other, different, specific key) (step 85), the system leaves the sampling loop, and proceeds to step 90. Note that this step requires that the operator, or some automated machine, make a decision that the quality everywhere on the map is sufficient for a given purpose. This step 85 can also be accomplished without a keystroke, i.e., the system can determine that all compartments meet required quality values and provide a signal to the operator, or an automated sampling probe, that sampling is complete", Vannah, column 11, line 43).

It would have been obvious at the time the invention was made for one of ordinary skill in the art to use the means and method taught by Vannah to stop a mapping operation with the adaptive mesh system of the combination of Delingette, Bernardini and Vannah to indicate that mapping is complete or to abort a mapping early.

Regarding claim 12, the combination of Delingette, Bernardini and Vannah does teach [a] medical imaging system comprising a suitably programmed computer or a special purpose processor having circuit means, which are arranged to form an image processing system as claimed in claim 11 to process medical image data ("DEC Alphastation 200/233", Delingette, page 137, column 2, paragraph 4; and display means to display the images ("the output device can be, e.g., a cathode ray tube or other screen, or a printer", Vannah, column 4, line 10).

Regarding claim 13, the combination of Delingette, Bernardini and Vannah teaches [a] medical examination imaging apparatus having: Means to acquire a three-dimensional image of an organ of a body ("The acquisition system 120 may be embodied, for example, as Rapid 3D Color Digitizer Model 3030, commercially available from CyberWare of Monterey, Calif", Bernardini, column 5, line 17 and "In this example. we reconstruct the ventricles, atria and the pericardium from a TI-weighted MRI volumetric image", Delingette, page 138, column 2, paragraph 2, the system could use MRI data or body surface data via a digitizer), and a medical imaging system according to claim 12 (as described above for claim 12).

Regarding claim 14, the combination of Delingette, Bernardini, and Vannah as given above teaches the system of claim 11.

The combination of Delingette, Bernardini and Vannah does not teach [a] computer program product comprising a set of instructions to be used in a system as claimed in claim 11.

Vannah further teaches [a] computer program product comprising a set of instructions to be used in a system as claimed in claim 11 (“The invention further features a computer program for analyzing the quality of sampled data points representing a property of an object and generating a feedback code indicating the quality of the sampled data points”, Vannah, column 4, line 26, Vannah teaches encoding a method as a computer program).

It would have been obvious at the time the invention was made for one of ordinary skill in the art to use the teaching of Vannah to create a software program to implement the methods of the combination of Delingette, Bernardini and Vannah in order to quickly and easily produce additional systems for sale and to allow convenient updates and improvements to the systems in the future via low cost software upgrades.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to THOMAS M. REDDING whose telephone number is

(571)270-1579. The examiner can normally be reached on Mon - Fri 7:30 am - 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/T. M. R./
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